A Simpler, Cheaper Alternative to Sewer Systems

Centralized Management of Decentralized Wastewater Systems

A Reality-Based Guide

New Mexico Environment Department

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EXECUTIVE SUMMARY

Who is this guide for?

For many communities in New Mexico, wastewater that is not adequately managed can contaminate the source of drinking water. Those communities can protect their drinking water by adopting centralized management of decentralized systems that collect and treat wastewater from every home.

Such systems are much cheaper than sewer systems.

This guide explains how communities can adopt such systems. Under New Mexico law, the following entities could function as a management agency, although some have more authority than others:

- every village, town, city, and county
- Water and Sanitation Districts
- mutual domestic water management associations
- cooperatives

A model ordinance, presented in the appendix to this guide, can be adopted by municipalities to codify these authorities. By adopting it, even communities that want to eventually install centralized sewer systems can start to better manage their wastewater problems now. Water and Sanitation Districts already possess the authority they need. Mutual associations and cooperatives can modify existing bylaws to establish the authority.

Government officials, citizens, environmental groups, the engineering community, civic groups, students, and anyone else concerned with this issue may also find this guide useful.

What advantages does a decentralized wastewater system offer?

- *Decentralized systems can help communities with one or more of these conditions:* existing septic systems are failing or inadequate; fractured bedrock or other geologic features may be facilitating contamination of groundwater; because population density is moderately low, centralized sewer systems would be needlessly costly.

- *Financially, decentralized systems are simpler—and therefore much cheaper—to construct than sewer systems.* They can cost half or even a third of what conventional sewer systems and central treatment systems cost.

- *Financially, they are an investment* that helps protect property values and the local tax base.

- *Financially, they cost no more to operate, maintain, and repair than sewer systems*.

- *Administratively, centralized management ensures good performance:* (1) existing onsite systems are thoroughly assessed; (2) necessary repairs and upgrades are made; (3) new onsite systems are properly designed, sited, and inspected during construction—and therefore built as designed; (4) homeowners are informed of their responsibilities; (5) all systems are properly maintained by a certified system operator.

- *Decentralized management can be phased.* Just conducting the initial assessment to determine baseline conditions is a huge step forward.

- *Decentralized systems can be constructed in stages, with costs phased over time.* The most urgent public health problems can be addressed first.

- *Communities of all sizes can benefit from decentralized systems.* While such systems are most common in rural areas, they may be cost-effective in low-density areas of towns, cities, and counties. Counties can form special districts to manage them.

- *Many different kinds of decentralized systems can be designed, to serve a wide variety of site conditions.* “Onsite” systems have traditionally relied on individual septic tanks. But new technologies offer many options and more flexibility in design.

- *Installing a decentralized system now does not preclude adopting a sewer system later.* Sewer systems have made a huge contribution to public health in cities around the world, but they require long lead times to arrange funding and complete construction. Communities pursuing sewer projects can start to protect their drinking water now by adopting an ordinance that codifies the legal authority needed to manage wastewater. They can then begin educating homeowners to their immediate responsibilities: determining the nature and condition of their onsite systems, identifying and addressing potential health problems, and maintaining their systems.

Why we wrote this guide

As the threat of contaminated drinking water grows, so will the need to adopt economical solutions to this problem. But while information on such solutions is abundant, many decisionmakers are not aware of it. This guide is intended to promote awareness and to offer practical steps toward implementing economical alternatives to sewer systems.

Those steps are based on the experience of a small New Mexico village, Willard.

A federal, state, and local partnership

The U.S. Environmental Protection Agency (EPA) makes grants to states to protect drinking water quality. Its 1998 Clean Water Action Plan identified 111 key action steps toward meeting water quality goals. Several steps concern decentralized wastewater systems and the need to demonstrate how barriers to implementing them can be overcome.

> *The performance of onsite/decentralized wastewater systems is a national issue of great concern to EPA*.
>
> Draft EPA Guidelines for Management of Onsite/Decentralized Wastewater Systems

The New Mexico Environment Department shares EPA’s goals and works to further them. Since 1999, with EPA funding, the State has been helping Willard develop centralized management of a decentralized system.

Developing that system proceeds by way of technical, legal, financial, administrative, and public involvement steps—some of which can present problems. While the Willard project is not yet complete, it has already illuminated the nature of these problems and how many of them can be avoided or minimized.

A tool kit to use and adapt

Drawing upon Willard's experience, this guide offers

- a matrix (on pages 13-14) that can help inform decisions about whether a sewer system or a decentralized system is more appropriate for specific community conditions
- realistic guidance for steps you can take in your community to adopt an alternative to a sewer system (a summary, "Step by step toward clean water" is presented on pages 27-28)
- identification of sources of funding and technical assistance you can tap
- a realistic appraisal of problems you may encounter
- recommendations for how to avoid or minimize problems related to defining baseline conditions, acquiring and managing an engineering firm, and informing and involving the public
- recommendations for how federal and state agencies can reduce problems and better promote adoption of decentralized systems
- a model ordinance establishing needed legal authorities
- other documents you can use or adapt

A caution is in order here: The Willard project employs a set of funding arrangements that cannot be exactly replicated, and it has been constrained by associated administrative requirements. In these respects, it has been both easier and harder than other projects may be. Thus, we intend this guide not as a blueprint but as a tool kit that can be adapted.

An indispensable companion to this guide is EPA's Office of Wastewater Management and its Web site, which offers a wealth of information and links to still other sites:

www.epa.gov/OWM/decent

Looking ahead

Other New Mexico communities are exploring Willard's approach to wastewater management. In a state in which water is such a precious resource, those initiatives are particularly important. We are committed to promoting and facilitating many such efforts, so that New Mexicans can realize the goal of ensuring a legacy of clean water for generations to come.

WHAT THIS GUIDE CAN OFFER YOU

Common-sense questions

Where does our drinking water come from?

Wastewater that we discharge from our homes is laden with the contaminants in human waste—nitrogen, disease pathogens, residues of medications, and other chemicals. Where do those contaminants go?

What do we know about the physical systems that collect and treat our wastewater? Where are they located? What condition are they in?

If, over time, contaminants are concentrating near the source of our drinking water, how could that water not *be contaminated?*

In the future, will our children have clean water to drink?

Who is this guide for?

This guide explains how communities in New Mexico can prevent wastewater from contaminating groundwater that supplies drinking water, by adopting centralized management of decentralized systems that collect and treat wastewater from every home.

Such systems are much cheaper than sewer systems.

Under New Mexico law, the following entities could function as management agencies, although some have more authority than others:

- every village, town, city, and county
- Water & Sanitation Districts
- mutual domestic water management associations
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A model ordinance, presented in the appendix to this guide, codifies these authorities. By adopting it, even communities that want to eventually install centralized sewer systems can start to better manage their wastewater problems now.

Government officials, citizens, environmental groups, the engineering community, civic groups, students, and anyone else concerned with this issue may also find this guide useful.

We urge readers unfamiliar with some terms used in this guide, to consult the glossary in the appendix.

What advantages does a decentralized wastewater system offer?

- *Decentralized systems can help communities with one or more of these conditions:* existing septic systems are failing or inadequate; fractured bedrock or other geologic features may be facilitating contamination of groundwater; because population density is moderately low, centralized sewer systems would be needlessly costly.

- *Financially, decentralized systems are simpler—and therefore much cheaper—to construct than sewer systems.* They can cost half or even a third of what conventional sewer systems and central treatment systems cost.

> **Do the Math!**
>
> Funds spent constructing costly sewer systems in low-density areas could benefit many more households if invested in centrally administered decentralized systems. Examples in New Mexico:
>
> - Edgewood, home to approximately 2,000 households, is considering building a $3 million sewer system that will initially serve only 20 businesses.
>
> - Columbus has spent $4.2 million for a sewer system to benefit 400 households. A decentralized system would have cost under $1.2 million.
>
> - Pena Blanca. To serve 133 households, a sewer system would cost $3.1 million; a decentralized system would cost $1.2 million. The village decided to install and manage the decentralized system to take advantage of the large cost savings.
>
> - Willard will spend an estimated $970, 000 to construct a decentralized system to serve 104 households; a sewer system would have cost $1.6.

- *Financially, they are an investment* that helps protect property values and the local tax base.

- *Financially, they cost no more to operate, maintain, and repair than sewer systems*.

- *Administratively, centralized management ensures good performance:* (1) existing onsite systems are thoroughly assessed; (2) necessary repairs and upgrades are made; (3) new onsite systems are properly designed, sited, and inspected during construction—and therefore built as designed; (4) homeowners are informed of their responsibilities; (5) all systems are properly maintained by a certified system operator.

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> *It's not your father's septic tank!*
>
> Participant at March 2001 conference on wastewater management, remarking on new technologies offered by vendors

- *Many different kinds of decentralized systems can be designed, to serve a wide variety of site conditions.* "Onsite" systems have traditionally relied on individual septic tanks. But new technologies offer many options and more flexibility in design. They are adaptable to a variety of soil and geologic conditions that don't lend themselves to sewer systems and to small lot sizes that previously required sewer systems. Some systems can serve clusters of homes. Biodegradation techniques and use of new materials in leach fields are accelerating treatment. Sensors that can be monitored from a remote computer terminal are simplifying inspection and maintenance. Sources of information about new technologies are identified in the appendix.

- *Installing a decentralized system now does not preclude adopting a sewer system later.* Sewer systems have made a huge contribution to public health in cities around the world, but they require long lead times to arrange funding and complete construction. Communities pursuing sewer projects can start to protect their drinking water now by adopting an ordinance that codifies the legal authority needed to manage wastewater. They can then begin educating homeowners to their immediate responsibilities: determining the nature and condition of their onsite systems, identifying and addressing potential health problems, and maintaining their systems.

Why we wrote this guide

The subject of centralized management of decentralized wastewater systems may be said to be "hidden in plain sight": the need for these systems is tremendous and growing; information on how to implement them is abundant. Helping decisionmakers recognize that a sensible solution is at hand is the biggest challenge.

EPA's commitment

The U.S. Environmental Protection Agency (EPA), under the 1972 Clean Water Act, makes grants to states to protect drinking water quality. Initially, these funds were for construction of sewer systems in major cities. In the 1980s EPA began providing capitalization grants for Clean Water State Revolving Funds that states can loan to local governments for water quality projects. Repayments replenish the fund so other local governments can borrow, too.

EPA's attention to water quality problems has been growing, and its 1998 Clean Water Action Plan identified 111 key action steps toward meeting water quality goals. Several steps concern decentralized wastewater systems and the need to demonstrate how barriers to implementing them can be overcome.

> *The performance of onsite/decentralized wastewater systems is a national issue of great concern to EPA*.
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> Draft EPA Guidelines for Management of Onsite/Decentralized Wastewater Systems

The State of New Mexico's commitment

The New Mexico Environment Department shares EPA's goals and works to further them. In 1999 EPA awarded the state a $70,000 grant for a demonstration project to develop a model ordinance and a manual that New Mexico communities can use to establish decentralized wastewater-management systems.

To simplify administrative requirements and leverage impact, the state chose to base its manual on the experience of an actual community working to address wastewater problems, and to provide that community with a one-time, $417,000 EPA grant to the state for hardship cases. That grant required that communities match 15 percent of the grant money with loans from the state's revolving fund loan—a loan that the state could arrange.

Willard's commitment

The community that stepped forward was Willard, a village of approximately 240 people whose principal drinking water supply, a well in the center of town, is threatened by contamination from human waste. Willard is developing its wastewater-management system in two phases. Phase I addresses critical potential public health problems. Phase I construction should be complete by the end of 2001. While the village has adopted an ordinance that imposes a fee on residents to repay a construction loan, as of this writing it had yet to adopt a fee to cover the costs of system operation and maintenance—and funding still must be obtained for Phase II. (These phases are discussed below in the section titled "Technical Options.")

A tool kit to use and adapt

Developing a decentralized system proceeds by way of technical, legal, financial, administrative, and public involvement steps—some of which can present problems. While the Willard project is not yet complete, it has already illuminated the nature of these problems and how many of them can be avoided or minimized. This guide recounts Willard's experience and what we have learned. It offers

- a matrix (on pages 14-15) that can help inform decisions about whether a sewer system or a decentralized system is more appropriate for specific community conditions
- realistic guidance for steps you can take in your community to adopt an alternative to a sewer system (a summary, "Step by step toward clean water" is presented on pages 27-28)
- identification of sources of funding and technical assistance you can tap
- a realistic appraisal of problems you may encounter
- recommendations for how to avoid or minimize problems related to defining baseline conditions, acquiring and managing an engineering firm, and informing and involving the public
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About this guide

This guide is available in hard copy from the New Mexico Environment Department Construction Programs Bureau. The electronic version can be accessed via a link on the Bureau's Web site:

http://www.nmenv.state.nm.us/cpb/cbppop.html

This will permit readers with Internet access to download and adapt sample documents in the appendix.

An indispensable companion to this guide is EPA's Office of Wastewater Management and its Web site:

www.epa.gov/OWM/decent

We encourage organizations working on wastewater-management issues to add a link to our Web site to their own Web sites. And we encourage you to share what you learn from your own project with the growing national network of parties tackling these issues, many of which are identified in this guide.

A word of thanks

Many people contributed time, energy, skills, and insight to this project. In particular, we want to acknowledge the contributions of Willard's Mayor, Louis Perea, and staff; Bridget Chard, an expert in community wastewater projects who is based in Minnesota; Jane Shautz, an expert in public involvement and wastewater projects, formerly with the Rensselaerville Institute, whose self-help guides are cited in the appendix to this guide; and Karen McBride, with the Rural Community Assistance Corporation.

WASTEWATER: THE BILL COMES DUE

Agua es vida.

The problem that may be confronting your community

In New Mexico, where water is a scarce resource of paramount importance, most drinking water comes from groundwater. Drinking water systems are managed by units of local government or water associations. Residents are billed monthly for the water they use. Such communal water systems are one of the benefits of living in a community.

But in many areas, the same water that enters homes by means of orderly systems is discharged from homes under lax conditions.

Over many generations, the cumulative effect of a community's wastewater collecting within a small area may be contamination of the groundwater from which drinking water is drawn.

This contamination is most commonly detected in groundwater, in the form of nitrates that result from nitrogen in human waste. Elevated nitrate levels signal that other contaminants from human waste may be present, such as antibiotic residues and disease pathogens not identified by routine laboratory testing of water samples.

State permitting of septic systems: good intentions

Over several decades, federal statutes and regulations have increased states' role in safeguarding drinking water. Because water is such a precious resource in New Mexico, our state government is extensively involved in issues related to water, with responsibilities distributed among many agencies. By 2001, a bill to consolidate and streamline these functions had been introduced in the state legislature.

The post-World War II housing boom that created suburbs also accelerated the installation of septic tanks. In 1973, to protect surface and groundwater from contamination by wastewater, the state adopted regulations setting standards for septic tanks and requiring anyone intending to install a septic tank to obtain a permit for it. Effective January 2002, the state is imposing a fee of $100 for each permit, to cover the cost of initial inspections.

The state's standards were revised in 1997 and are now being reviewed again. A community can adopt standards more stringent than the state's, and the model ordinance developed for the Willard demonstration project are more stringent. (More information on the ordinance is presented below and in the appendix.)

Administrative gaps in records

Theoretically, for every septic tank constructed in New Mexico since 1973, the state should have an approved permit on file. But state offices are understaffed, records of permits are not complete, and only now are they being computerized. Moreover, not all homeowners who installed systems obtained a permit.

Thus, the state's records cannot be relied upon for authoritative information on whether a given piece of property does or does not have a septic tank, or, if it does, how old the tank is.
And because current regulations do not require regular inspections and because the state does not have enough staff to routinely inspect tanks it permits, its records cannot indicate the current condition of the tanks.

Pervasive physical problems

Even proper permitting is no guarantor of performance, for a variety of reasons:

- *Lot size.* To ensure adequate room for a septic tank and an existing well, the state will not issue a permit for a septic tank installed on property smaller than ¾ of an acre. But some engineers believe at least 2 acres are required to properly dilute wastewater and prevent contamination of drinking water. And in areas in which population has grown and lot sizes are small, dilution is limited and higher levels of treatment are therefore required to treat groundwater.

- *Poor design* can result in poor performance.

- *Poor construction* can result in poor performance. Because the state lacks the manpower to closely monitor septic system installations, the system installed may not match what was permitted. And the state cannot monitor actual performance.

- *Inadequate maintenance* results in poor performance. Some homeowners are not aware of their responsibilities for maintenance or may not choose to meet them because they feel they cannot afford to. And many septic tanks are buried and forgotten. Without maintenance, they are prone to failure and can result in contamination of groundwater.

The bottom line

The consequence of all these problems is that we don't know how many septic tanks are permitted in New Mexico, how many are functioning properly, how many have failed. In short, we don't know the scope of our state's wastewater problems.

But nationally reported failure rates for septic tank systems of 10 to 30 percent suggest that the problems are probably significant, and becoming more so with every passing day. The American Society of Civil Engineers "Infrastructure Report Card," issued in March 2001, identifies a nationwide funding shortfall of $12 billion a year for the next 20 years for wastewater management.

Why wastewater problems matter

The federal Safe Drinking Water Act requires sampling of community drinking water systems as water comes out of the tap. Samples must be taken once a year to measure levels of nitrates and other contaminants; once a month to measure bacteria. In New Mexico, the state Drinking Water Bureau conducts this sampling.

After a problem is initially detected, further sampling is conducted. Meanwhile, water quality can continue to deteriorate, and serious health risks can develop even within 30 days. Residents may be required to boil water, or a new source of water may have to be found, at considerable expense.

So serious is this problem that federal and state law both forbid contamination of groundwater. That water belongs to all New Mexicans and to future generations, and a community's right to draw water from an aquifer is a right granted by the state. In discharging uncontained and untreated contaminants into the ground and possibly contaminating groundwater, residents could be violating the law.

Beyond legal considerations, in New Mexico alternative sources of water are not readily available. A community whose drinking water supply is contaminated will see property values fall and may eventually cease to function.

Why wastewater problems persist

From the homeowner's standpoint, addressing wastewater problems may be a low priority, in part because unlike solid waste, which accumulates until it is carted away, wastewater literally vanishes from sight.

By contrast, community systems that supply water to households are a high priority: we need water every day. And it would seem obvious that households served by a water-supply system are identical to those that should be served by a wastewater-management system; the latter is simply an extension of the fact that water piped into our homes will be discharged from our homes. The costs of both should be considered a continuum. But homeowners not accustomed to paying for wastewater management may resist paying a new fee for a new service.

Where wastewater issues *are* addressed, historically a variety of factors have converged to shape a widespread preference for centralized sewer systems even when those systems are not cost-effective.

One factor arises from problems caused by faulty septic tanks: septic tanks that are not maintained pose health and environmental hazards and contribute to a perception that septic tanks are less reliable than sewers—although sewers can leak, too, and when they burst wreak far more disruption.

Similarly, some homeowners believe sewer systems increase property values—although paying for them may cause property taxes to rise.

From a public policy standpoint—and more narrowly, from a public *health* standpoint—public funds can often deliver far more benefit if they are invested in decentralized systems. But not all government funding agencies routinely require consideration of decentralized systems. Typically, agencies are more familiar with sewer systems and pose fewer questions about funding them. Lack of adequate up-front funding for decentralized systems is another barrier—and a severe one for the small, economically disadvantaged communities that may need those systems most. Those communities are also deterred by needlessly burdensome administrative requirements.

Other reasons are rooted in the engineering community. Generally, engineering schools have not taught students about decentralized wastewater systems, and many engineering firms, accustomed to designing sewer systems, have yet to learn about the growing range of technologies for them.

Financial incentives are at work, too:

- If engineering fees are defined as a percentage of construction costs, designing and monitoring construction of a sewer system can be more profitable to an engineering firm.

- Many local businesses and developers don't know that new onsite and cluster technologies can be tailored to small lots. They typically consider only sewer systems. Developers tend to promote sewer systems because the cost is borne by the public, not the developer, and the systems can serve small lots and therefore more lots. Sewers thus not only accommodate growth; they encourage it.

Comparison of decentralized wastewater systems and sewer systems

Both decentralized wastewater systems and centralized sewer systems perform three functions:

collecting wastewater from each home
treating wastewater to reduce levels of contaminants
dispersing the treated water in an environmentally acceptable way

Each system has strong advantages in certain situations. Their attributes are described below.

Attribute	Decentralized System	Sewer System
Availability of funding	Historically, funds more limited and harder to obtain, but this is rapidly changing	Historically, more funds available; easier to obtain.
Need to obtain easements	If only individual septic tanks are used, no easements are needed. If cluster systems are used, too, some easements may be needed.	Easements will be needed.
Cost to construct	Less than 1/2 or even 1/3 of sewer system Construction involves digging trenches to lay pipeline from homes to onsite systems; excavating existing substandard systems and repairing or replacing them; and excavating sites for new onsite systems, installing them, burying them, and constructing adjacent leach fields. Excavation and trenching occur within existing road right-of-ways and residential lots.	Most cost-effective in high-density areas. Not cost-effective in low-density, rural areas; 75 percent of cost is pipe. Sewer systems require (1) acquiring land for a central treatment facility, (2) laying pipe to transport wastewater from every home to the facility, (3) using larger-diameter—and therefore more costly—pipe to handle larger volumes of water, (4) constructing the central treatment facility.
Cost to operate & maintain	Should be cheaper.	Likely to be more expensive.
Public acceptance	Public perception of “leaking septic tanks” has hurt. Centralized management would ensure regular maintenance and inspection and prompt repair.	Public perceives sewers as preferred option and may believe they will increase property values, although property taxes may rise accordingly.
Flexibility of technical options	Considerable and growing fast. Can be adapted to wide range of site conditions.	Many treatment options, but once installed, inflexible and costly to modify.
Consequences of system failure	Limited to single home, or at most a cluster; has less impact on the environment. Relatively inexpensive to repair.	Can be catastrophic: disruptive to a large neighborhood and source of public outrage. Costly to repair.

Attribute	Decentralized System	Sewer System
Impacts on growth	Doesn't promote growth but can accommodate it, as new systems are easy to install and advanced treatment systems can be tailored to small lots.	Tends to promote growth. Developers favor sewer systems because public bears cost and small lot sizes mean more homes can be hooked up.
Dependence on homeowner acceptance and cooperation	Significant at start of project; minimal once system is in place. Homeowner permission is needed for initial survey to determine baseline conditions. Homeowners must accept project and its cost. Homeowners must pay for operations and maintenance, usually in the form of a monthly user fee. Inspectors will access property for periodic inspection, pumping, maintenance, and repairs. Centralized management can enforce this. Homeowners must be educated to only dispose of materials the system can accept.	Significant at start of project; minimal once system is in place Homeowners must bear construction costs, which may have low visibility, as with a bond issue, or high visibility, as with property tax increase. Homeowners must pay for operations and maintenance, usually in the form of a monthly user fee. No onsite inspection, pumping, maintenance, or repairs. Homeowners must be educated to only dispose of materials the system can accept.
Recordkeeping	Integral to centralized management.	Integral to centralized management.

THE WILLARD PROJECT: SETTING THE STAGE

The place: a village in rural New Mexico

Location and origin

Willard is located in a rural area of Torrance County, New Mexico, a region characterized as semiarid high desert. The elevation is approximately 6,000 feet. Occupying approximately 130 acres, the village is flat, with a slight grade to the southeast.

It was founded in 1902, along the Atchkinson, Topeka & Santa Fe Railroad, and became a rail shipping port for local ranchers and farmers.

Maps showing Willard's location in the state and its downtown area can be viewed at Web sites such as http://maps.yahoo.com and www.expedia.com. On those sites, enter "Willard NM United States" and zoom out and zoom in. Or click directly on this link and zoom in:

Willard Map

Population: past, current, projected

Willard's population peaked in the 1930s at 482 people, but shrank with curtailment of railroad operations during the 1950s, 60s, and 70s. The 1990 census recorded 183 residents, but the population has been growing, and the 2000 census recorded 240 persons, of whom over 83 percent were Hispanic. It is estimated that by the year 2020 the population may range from 234 to 394 people.

Data on median household income for 2000 are not yet available; for 1990 the figure was $15,417, with 12 percent of households then below the poverty line and approximately 25 percent of the population over 65.

Infrastructure and economy

Willard's physical infrastructure consists largely of single-family homes constructed on site, mobile homes, and manufactured housing. Most homes are within a 50-acre area.

In the center of the village are the Village Hall, a U.S. Post Office, and a community center. Nearby are two churches, a former gas station, a senior center, a fire station, a construction company, and a cantina.

The village has no zoning ordinances. All streets, with one exception, are unpaved.

Children in the village are bused to schools in nearby towns.
Trains no longer stop in Willard. It has no industry and little economic base. Farming and ranching are the primary sources of income in the area. A large dairy is located nearby.

Local government

Willard is a village. Under New Mexico law, villages have the same powers as other forms of local government: towns, cities, and counties. Its elected officials include an unpaid, part-time mayor and a four-member council. Official business is transacted at council meetings, held once a month.

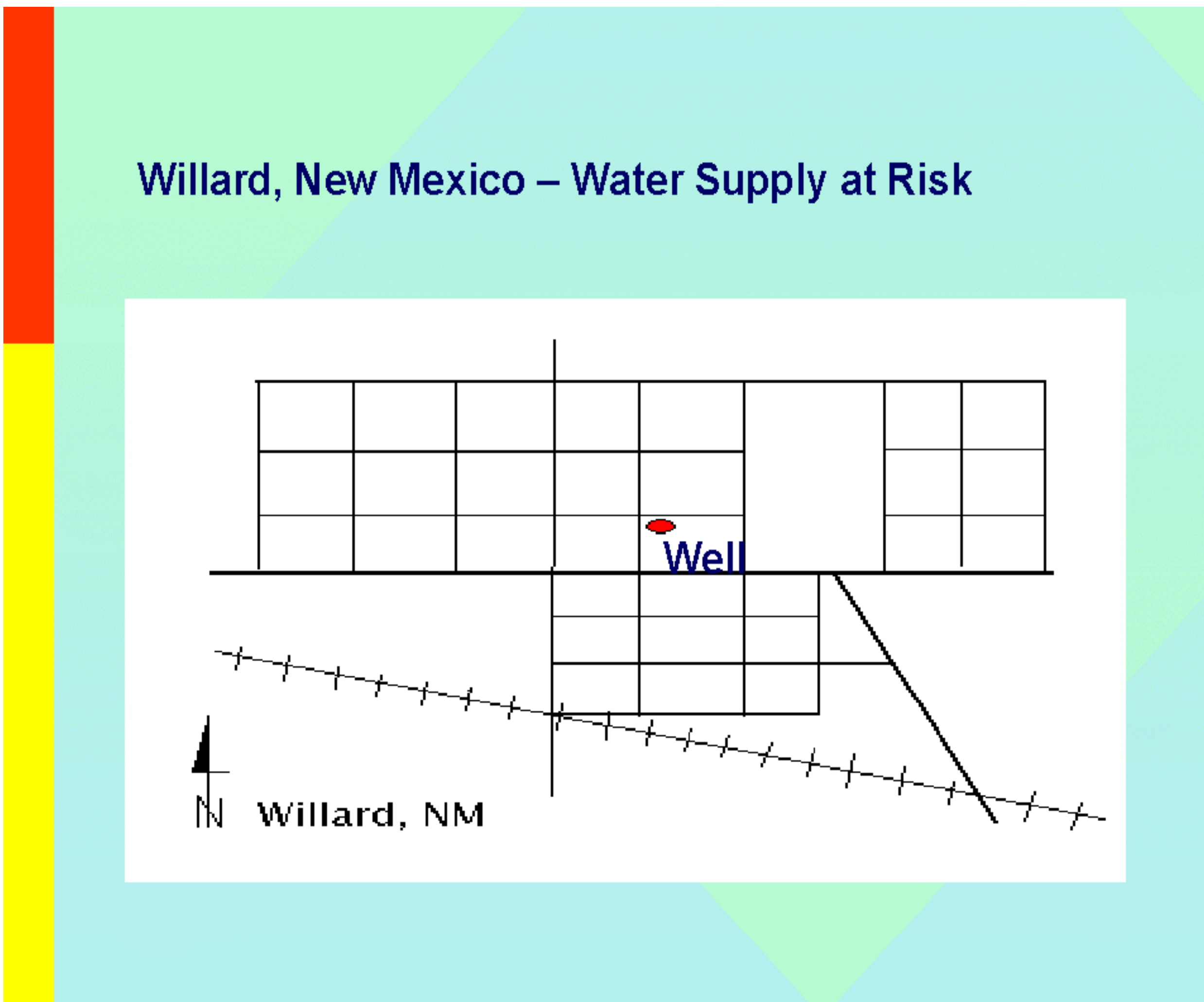
Paid officials include a part-time employee who operates the village drinking-water-system, a bookkeeper, and a village clerk. For the first year-and-a-half of the Willard wastewater project, the position of clerk was part-time; it later became full-time.

The problem: a threat to Willard's drinking water

Where Willard's drinking water comes from

In this semi-arid environment, water is a precious resource. Mountains to the east shelter Willard from precipitation; annual rainfall averages 12.5 inches.

Like most New Mexican communities, Willard obtains its drinking water from groundwater. The aquifer is tapped by a community well in the center of the village that was constructed in 1971 as part of a drinking water system for the village. The system has 102 water-user accounts, almost all of them households and most of them concentrated within a 50-acre area; approximately 40 homes are within a 885-foot radius of the village well.



Drill logs from the 1970s indicate that water levels then were 40 feet beneath ground surface. Logs for wells drilled in the 1990s indicate that the water level had dropped to 80 to 90 feet below ground surface. The fact that water is being removed faster than it is being replaced serves as a reminder that water is scarce.

Some private wells are still active within the village and several large irrigation wells are located south of it.

Where Willard’s wastewater goes

Like many communities, Willard constructed its drinking water system without regard to how to manage that same water *after* it is used in each home. To minimize the amount of pipe that had to be laid to each home and thus limit construction costs, the village chose to locate the well in the center of town. But this economy had the effect of concentrating wastewater discharged from nearby homes in a small area close to the well. Of the over 20,000 gallons of wastewater that Willard’s households discharge each day, approximately 40 percent is filtering through soil within the 885-foot radius of the well. Eventually, it migrates back into the aquifer from which it was drawn.

The pieces of the water-quality puzzle

While the quality of Willard’s groundwater had generally been considered good, recent samples indicated elevated levels of nitrates.

- Federal regulations under the Safe Drinking Water Act define 10 milligrams of nitrate-nitrogen per liter as the limit for safe drinking water.
- Background levels of nitrates in the area around Willard are 0.2 to 0.3 milligram per liter.
- Nitrate levels in Willard’s well water were as much as nearly 10 times higher than background levels.

While nitrate levels may indicate human contamination, a strong caution is in order. As discussed below under “Making decisions in the face of uncertainty,” data from sampling alone cannot be relied on to assess the severity and trend of wastewater problems. Rather, they must be assessed within the larger context of a specific physical setting and its known history.

In Willard, data from water sampling became significant in light of other factors:

- The village well is located in the center of town, with about 40 homes within 885 feet of the village well and most homes within a 50-acre area.
- Each household is responsible for its own system for collecting and treating wastewater.
- Village officials realized that approximately 40 of the village’s 102 water-system users might lack septic tanks, and they suspected that of the septic tanks known to exist, some were not in good condition.
- Abandoned wells and cesspools could be serving as conduits by which contaminants migrate to the aquifer.

Together these factors suggested that some wastewater was being discharged directly into the ground and migrating to the aquifer from which the village was drawing its water.

Another factor lent weight to this suspicion: industrial and agricultural processes can produce nitrates, but no industry is present in Willard, and local topography prevents nitrates from the nearby dairy farm from migrating to the source of village well water.

Village officials recognized that Willard was facing a potentially serious, and worsening long-term problem.

Willard's needs

Concerned about the threat of contaminated groundwater, in March 1999 Willard's mayor asked the state for a $50,000 loan to install 40 septic tanks.

Because Willard met the criteria for the EPA hardship grant, the state invited Willard to pursue a formal project that would include consideration of a decentralized system. While the state could supply technical assistance and make available the hardship grant and a revolving fund loan, decisions about how to address wastewater problems would rest with Willard.

The mayor agreed to pursue the project, and the state facilitator began to help launch it.

The Willard project serves several goals:

- For EPA, it directly furthers the goals of the Clean Water Action Plan.
- For the state, it is producing (1) a demonstration project that other communities can learn from, (2) this guide, (3) a model ordinance that equips communities with the legal authorities they need to ensure proper operation and maintenance of their systems.
- For the village, it will safeguard drinking-water quality for years to come.

A FRAMEWORK FOR SUCCESS

From the start of the Willard project, Willard officials, the state facilitator, and EPA knew that while external parties could help, control and responsibility would and must rest squarely in local hands.

They also knew the project would require

- a sound planning process that provides for public involvement
- a legal framework that affords the authority to manage the system
- collaboration among many partners
- communication skills essential to facilitating public education and involvement
- the public acceptance essential to launching the project
- knowledge of funding sources necessary to secure funding
- procurement of engineering and construction services
- public acceptance of user fees that would be imposed to cover the cost of repaying construction loans and for operation, maintenance, and repairs
- the ongoing public commitment essential to long-term success
- perseverance, and the ability to learn from mistakes!

In the pages that follow, rather than recount the entire Willard project story in detail, we focus on matters that may be most helpful to you. So you can readily zero in on what you want, some information is presented in narrative form, some in tables, and some is crosscut in several ways. A detailed chronicle of the project is presented in the appendix.

Please note that the order in which topics are presented does not reflect their importance but rather is intended to present information in the sequence most helpful to understanding the Willard story.

A sound planning process and substantive public involvement

The planning process was shaped in part by the fact that the Willard project uses federal funding that triggers EPA regulations and the requirements of the National Environmental Policy Act (NEPA). State funding imposed requirements, too.

But even in the absence of federal and state funding, the basic steps below are essential to ensuring an orderly planning process that promotes substantive public involvement. From an engineering standpoint, public involvement is valuable, because citizens can contribute relevant knowledge of local physical conditions. And the extent to which the public genuinely "takes ownership" of the project will determine its success over the long term. This last point is crucial to long-term success: if residents feel a system has been imposed on them, they may not meet their ongoing responsibilities for using the system properly and facilitating its maintenance. A substantial investment will be eroded; the threat of public health problems may reoccur.

As a framework for understanding information in subsequent sections that describes project partners' roles and project milestones, some explanation of key project steps is necessary here:

- Before funds could be loaned to the village, a preliminary engineering report had to be prepared. It (1) assessed the problem, (2) identified and examined technical options for collecting, treating, and discharging wastewater; (3) assessed the cost of each option; and (4) recommended a preferred option.

  (Under EPA regulations, the document is termed a *facility plan.* In the private sector, it may be termed an *engineering report.*)

- The preliminary engineering report had to be accompanied by a draft environmental assessment of socioeconomic and environmental impacts of the technical options.

- Both documents had to be issued for public comment, and a public hearing had to be held to receive comments: the public had to be formally notified at least 30 days in advance that the documents were available for review and that a formal public hearing would be held to receive oral or written comments.

- Public comments had to be evaluated and the documents revised, as appropriate.

- For the environmental assessment to result in a formal Finding of No Significant Impact, a public notice had to be issued and comments received and considered.

- Only after a preferred option had been selected and the NEPA process was complete could the revolving fund loan from the state to the village be executed. And only then could the engineer proceed to prepare plans and specifications for construction.

Necessary legal authorities

Existing legal authorities essentially empower units of government to lay pipe in the street for sewer systems but do not explicitly empower them to “go into the yard” of a homeowner. Thus, a question arose: did existing statutory language provide the legal authority needed to administer a decentralized wastewater management system?

The functions for which authorities needed are the following:

- obtain easements to gain access to property so construction can proceed
- impose a fee on each homeowner to pay for operating and maintaining the system and for educating homeowners to their responsibilities
- require that new onsite systems meet technical specifications appropriate to the community
- if necessary, require an unwilling homeowner to accept installation and the functions necessary to operation and maintenance of an onsite system
- monitor drinking water wells to determine levels of contaminants
- gain access to property so that trained personnel can periodically inspect, maintain, repair, and if necessary replace system components and the leach fields into which they drain and can pump septic tanks
- enforce requirements for maintenance by imposing penalties for noncompliance such as shutting off water or placing a lien on property
- after installation and repair of the decentralized system is complete, require that property owners building new homes install onsite systems at their own expense

A model ordinance supplies authority

An attorney contracted by the state facilitator researched case law and determined that existing law appears adequate to support explicit ordinances.

Drawing from ordinances used in other states, the facilitator drafted, and the attorney reviewed, a model ordinance for villages, towns, cities, and counties. It explicitly establishes needed authorities: the authority to establish a wastewater system and define performance standards for it, to inspect and maintain it, and to impose a user fee. The final ordinance sets performance standards more stringent than the state’s but leaves to the state responsibility for permitting.

Mutual domestic wastewater associations and cooperatives need only a small addition to their bylaws to establish the authority to manage wastewater systems. The New Mexico Environment Department can help them determine what language should be adopted.

The appendix to this guide includes a section titled “Necessary legal authorities and other legal matters” that provides more detail on this and related legal subjects. It also contains a section on the model ordinance.

Project partners and their roles

The Willard story is a story of resourceful collaboration. The principal parties are identified below and their roles are sketched so readers can readily see who did what. Key steps are described in greater detail further below.

Because the Willard project is still under way, we have used the present tense for all actions. And we have indicated some actions not taken that might have been useful.

The indispensable but informal role: *project champion*

One of the most important roles is not formally assigned to any one party. Rather, it is performed by those individuals who step forward to exercise leadership or otherwise build support for the project at crucial junctures. "Champions" have included the mayor, a local community leader, the state facilitator, and an expert on public involvement.

In fact, the role can be played by anyone with time, energy, motivation, and perseverance. Access to resources is a further advantage.

The role of village government

The council seeks and considers public input on decisions under consideration.

- The mayor initiates action by approaching the state for a loan for septic tanks. He moves the project forward at critical points.
- The village clerk facilitates communication among principal parties and residents.
- To acquire engineering services, the council issues a Request for Proposals (RFP), evaluates proposals, selects a winning firm, and executes a contract with it.
- The council secures funding by obtaining a bridge loan from the Rural Community Assistance Corporation (RCAC) and executing a loan agreement with the state that qualifies it for a grant. The bridge loan is needed to pay an engineering firm to produce the preliminary engineering report that must be submitted in order to obtain the loan from the state. (Bridge loans are now available from the state.)
- The village manages engineering services through three formal phases: planning, design, and construction.
- The council evaluates and approves the engineering firm's preferred technical option.
- The village, with the services of an attorney, acquires necessary easements or purchases needed land.
- The council determines (1) what funding mechanism should be used to repay the loan and the costs of operations, maintenance, and homeowner education; (2) what fee to set.
- To acquire construction services, the council issues specifications for bids, evaluates bidders, selects one, executes a contract, and upon recommendations from the engineering firm, which monitors construction services, approves payments and change orders.

- The village manages expenditures and maintains accounting records.
- The village will administer the operation and maintenance of the system in perpetuity.

The role of Willard residents

- Willard citizens learn, help, and participate by

  attending public meetings

  serving on an advisory committee to review engineering proposals and select a firm

  helping to conduct a house-to-house survey to gather information about existing systems and cooperating with the survey

  cooperating with field verification of survey results

  making their private wells available for water-quality sampling and monitoring

  reviewing the preliminary engineering report and raising questions and comments

  helping the village identify owners of property needed for easements

  They may

  form an advisory committee to work with the engineer in identifying and developing options

  The could have

  formed a liaison committee; for example, to help the village council develop the fee schedule for maintenance and operation

- *Note:* The role of county government in New Mexico is limited; Torrance County does not figure in this project.

The role of state government

- The New Mexico Environment Department stands ready to help communities not only with funding but by providing technical assistance on many aspects of wastewater projects.

- An Environment Department official, the "state facilitator," has performed many functions, some unique to the Willard Project because of the nature of its funding sources. They are detailed in the appendix, in the "Chronicle of project progress."

- The Drinking Water Bureau presents a groundwater exhibit at a public meeting; pays for the house-to-house survey; pays for nitrate analysis through an existing contract with a lab.

- The Engineer's Office, which issues permits for construction of wells and maintains geologic drill logs from those wells, provides useful data.

- The Environment Department District Office issues permits for onsite systems.

The role of EPA

- EPA provides funding, information resources, and guidance.

The role of a non-profit organization

- Rural Community Assistance Corporation (RCAC)

    provides a crucial bridge loan

    helps the village prepare its application for a state revolving fund loan

    serves as a neutral third party by conducting the surveys that are the basis of the engineer's needs assessment

    helps the village determine a fee structure and draft an ordinance to implement it

The role of the private sector

- Consultants bring expertise in public involvement and creation of wastewater-management districts in other states.
- An engineering firm under contract

    develops a preliminary engineering report

    prepares an environmental information document that contributes to the environmental assessment prepared by the state facilitator

    prepares specifications for a bid solicitation for construction services and for the contract executed with the winning firm

    monitors construction by providing construction management services

    prepares a guide to operations and maintenance of Willard's wastewater system

    ensures compliance with federal and state laws and regulations and local ordinances

- A construction company under contract constructs the system

Timetable: how long will your project take?

Some time intervals are specified by law. For example, NEPA and state procurement requirements typically involve public notice, competition, evaluation, selection, negotiation, and execution of a formal contract.

But the Willard project has taken far longer than originally expected. The original schedule assumed 1 year would elapse from the state's March 1999 meeting with the mayor to completion of construction. The actual schedule for Phase I alone is more than twice as long.

In retrospect, this seems inevitable, for a set of reasons:

- The funding and partnering arrangements were unique and together necessitated slow steps.
- The fact that the project was a demonstration meant there was no precedent in New Mexico from which we could learn. Indeed, the Willard project is the only demonstration project in the southwestern United States on EPA's Office of Wastewater Management Web site.
- It was hard to schedule meetings among parties who were geographically distant. The state facilitator worked full-time in Santa Fe, 84 miles and about 1 and ¾ hours away from Willard. The engineer is based in Socorro, 76 miles away.
- Communication was slowed by the fact that the village does not have e-mail, and for the first year-and-a-half of the project, the village clerk worked part-time.
- Shortly after the project began the village clerk left, and her replacement could not locate documents essential to the bridge loan application.
- The village had no attorney to review and certify documents and it was therefore necessary to obtain this service and pay for it.
- The RCAC bridge loan for the engineering report was delayed because records documenting village incorporation had been destroyed in a fire in 1912.
- RCAC had never executed a bridge loan for a revolving fund loan, and it had to establish its own procedure in cooperation with the New Mexico Environment Department.

Possible sources of uncertainty for your project

The following factors can introduce uncertainties

- How long it takes to obtain funding can affect schedule.
- How long it takes to gain community support can affect not only schedule but the availability of funds: some sources may expire.
- In some cases, acquiring needed easements or purchasing needed land may be time-consuming. For example, in an economically depressed area where there have been no recent property sales, it may be difficult to determine a fair market value. It may even be difficult to determine who owns some property, or to contact the owner.

- Actual construction costs may differ from earlier estimates; for example, a spike in the cost of oil can drive up the cost of petroleum-based products like plastic pipe; a tight labor market can drive up labor costs.
- Construction projects often encounter site conditions that could not have been anticipated and that affect cost and schedule.

But it seems likely that other projects will progress more rapidly than Willard’s, in part because they can directly benefit from our experience.

Step by step toward clean water: Willard's milestones

Below is an overview of milestones for Willard's project. Milestones *not* common to all projects are indicated in blue.

It is important to note that project goals, progress, and pending decisions have been discussed at council meetings and other public meetings since the inception of the project.

The appendix to this guide presents documents that can be adapted for use in some of the steps in your project, and it lists sources you can contact for other documents.

Project launch phase

Village council commits to project.

State facilitator enlists RCAC, a public interest group that can provide a bridge loan and technical assistance; contracts with them to conduct a house-to house survey to determine baseline conditions.

State facilitator drafts RFP for preliminary engineering report.

Village issues RFP for engineering report and places ad in paper announcing RFP.

Residents' advisory committee screens and evaluates proposals from engineering firms.

Village selects engineering firm.

State facilitator drafts contract for engineering report.

Village contracts with engineer for engineering report.

Formal planning phase

Physical baseline is established. With help from residents, RCAC conducts house-to-house survey to gather information on existing systems. RCAC subcontracts field survey of physical condition of existing systems to determine baseline conditions.

Engineer prepares preliminary engineering report identifying and assessing technical options, estimating costs, and recommending one option.

Village holds public meeting to review preliminary engineering report.

Engineer drafts environmental information document assessing potential environmental impacts of each options considered.

State facilitator draws on environmental information document to draft environmental assessment.

Village holds public comment period on preliminary engineering report and draft environmental assessment, including public hearing.

Engineer finalizes engineering report and environmental information document per public comments.

State facilitator prepares final environmental assessment and determines Finding of No Significant Impact.

Village submits engineering report to the state, which approves it, triggering approval of revolving fund loan to village.

Village executes loan documents and authorizes engineer to proceed to design phase.

Design phase

Throughout design and construction, engineer ensures project meets federal and state regulatory requirements.

Engineer prepares plans & specifications for construction phase.

State funding agency reviews and approves the plans and specifications.

Village adopts ordinance establishing fee for repayment of state loan.

Village acquires necessary easements.

Village advertises for bid for construction work and awards contract.

Construction phase

Construction begins.

Engineering firm monitors construction and recommends approval of change orders and payments.

State funding agency reviews and approves requests for payment.

On recommendation of engineering firm, village determines construction acceptable and complete and makes final payment.

Operations and maintenance phase

Village assumes responsibility for operations and maintenance.

DEFINING THE BASELINE

An accurate description of baseline physical conditions is the foundation for much of the work that follows. For an engineering firm to examine and estimate the cost of technical options and recommend a solution, it must understand the nature and condition of existing septic systems—and where such systems are inadequate or altogether lacking. The firm must also understand local soils and geology.

The most valuable sources of information about septic systems are homeowners and what can be learned by physically examining their property.

This section of our guide describes how Willard's baseline wastewater systems were defined. (The engineering firm later examined the nature of soils and geology.) The scope of your effort to define baseline conditions will depend upon how much is already known about them at the start of your project and how difficult it is to acquire additional needed information.

Conducting a survey

Originally, it was intended that the engineering firm would conduct a survey to determine baseline conditions. But while the funding arrangements necessary to execute the engineer's contract were still in progress, it was decided to expedite the survey by having a third party conduct it. This arrangement also had the merit of avoiding any perception by residents that the engineering firm would benefit from survey findings recommending a project that the firm would then be paid to design.

The third-party role was played by RCAC. Funding was provided by the state Drinking Water Bureau. The Bureau wanted to use the data that would be acquired about village wells for the global positioning system database it is creating for its wellhead protection program, which identifies potential sources of contamination.

The survey was conducted in two parts.

Part A – house-to-house survey of residents

Part A was a house-to-house survey to gather information from residents about the nature of the systems on their property—or the lack thereof. It proceeded by way of the following steps:

- Notifying residents, through public meetings and flyers, of the purpose of and need for the survey.
- Designing a clearly written survey form that would capture pertinent information.
- Identifying each piece of property and its owner. This proved difficult: the village lacked an accurate detailed map; some property had been abandoned; records were incomplete. Aerial photos proved the best source of information for identifying property.
- Recruiting residents to help with the survey and briefing them on how to conduct it. RCAC assumed that interviewers would gather information from residents by querying them and filling in their answers on the survey forms. Instead, the volunteers distributed the forms directly to homeowners for completion by them. This led to some confusion. For example, people who didn't know exactly what they have in their backyard reported that they had a "cesspool" although in fact they have a standard septic system.

However, direct distribution of forms did have the merit of expediting data collection; most were returned within 1 week.

- Compiling and interpreting survey findings, which largely confirmed village officials' original estimates.

Part B – field verification of results of house-to-house survey

Part B consisted of field verification of information gathered in Part A. It was conducted by a local septic-tank pumper under subcontract to RCAC. A tremendous benefit of this arrangement was the fact that the pumper was already known to residents and trusted by them. Many homeowners who initially refused RCAC staff access to their property extended it to the pumper because they knew him.

This task proceeded by way of the following steps:

- Holding a public meeting to present the results of Part A of the survey and to explain why Part B was needed and how it would be conducted.
- Designing a clearly written survey form that would capture pertinent information.
- Directly contacting each homeowner and explaining (1) why Part B of the survey was needed and how it would be conducted, (2) that field verification would damage nothing on their property, (3) that no enforcement action would be taken against substandard systems.
- Conducting the survey.
- Compiling and interpreting the findings. Findings indicated confusion caused by Part A, described above, but otherwise largely confirmed what homeowners had reported. Not surprisingly some of the approximately 20 homeowners who had not returned Part A proved not to have septic tanks.

Forms for Parts A and B of the survey are included in the appendix. (Part A has been revised since it was used in Willard, so that if homeowners do complete it themselves they can more readily understand the kind of information sought.)

Also included in the appendix are the names of organizations that have developed national standards for septic tank inspections and certification programs to qualify individuals as inspectors.

Because of the possibility of bacterial contamination, a health and safety plan should be adhered to in conducting the field verification.

Survey findings

Eighty-six homes were surveyed. Property not surveyed belonged to owners who had recently received permits from the state that provided the information needed. Of the homes surveyed, 6 were inaccessible (for example, one septic tank was located beneath a room that had been added to the home), or the homeowner refused an inspection, or no onsite system could be located on the property.

Of 79 homes surveyed,

46 use septic tanks with a leach field
4 use septic tanks without a leach field.
24 use cesspools, seepage pits, holding tanks, or lack a system altogether
36 were operating systems more than 10 years old
29 percent were reported to have problems including odors, sewage backups, and sewage surfacing in yards

Ancillary benefits of field verification

Field verification identified some active health hazards that were more severe than expected, and some public nuisances. For example, an abandoned hand-dug well lacked an adequate cover; a cesspool was starting to cave in. The village is now aware of these public health problems.

And as a result of the survey, the village has acquired a much more accurate map of its infrastructure.

Examining other sources of information

Before the village well was drilled in 1971 and a community water-supply system was built, households had their own wells. Household wells are still used for irrigation for lawns and trees. One was drilled as recently as 1997.

Because samples taken from household wells can identify contamination and because the wells could serve as conduits for pollution, we examined some of them. But generally they did not prove very useful, for several reasons.

First, we realized that the oldest wells probably aren't serious pollution conduits because they were dug by hand and are shallow—roughly 40 feet, the depth of the aquifer several decades ago before cumulative withdrawals caused the water table to fall.

Second, several well houses, such as those constructed of adobe that is now crumbling, are so deteriorated that the wells could not be safely accessed.

Third, old wells that could be sampled posed a host of uncertainties: because documentation of their construction is limited at best and usually non-existent, we could not determine how deep the wells are or at what depths they pump water. We therefore could not draw conclusions about the source and significance of the samples.

And one well produced anomalous sample results: expected to show low levels of nitrate because it is located on the far east of town near an old landfill, it produced a sample with 5 milligrams per liter of nitrate—5 times higher than other samples. This finding is related to the problem discussed below.

Making decisions in the face of uncertainty

The severe limitations of data from household wells left us largely dependent on data from the village well in the center of town.

The data on nitrate levels in Willard's drinking water were supplied by the state Drinking Water Bureau. Those data went back 6 years, but because the state samples for nitrates only once a year, this constituted a small number of samples. Waiting to acquire more annual samples could permit the level of contamination to rise. Alternatively, drilling monitoring wells would add cost.

But even those options could not be relied upon, because sampling by its nature can yield data that are ambiguous and even conflicting, and samples taken at the same time in nearby locations can differ markedly because of variation from site to site.

Further ambiguity is inherent in laboratory analysis: splitting a single sample and sending the splits to two different laboratories can produce different results.

But the bulk of sampling data acquired over recent years did indicate elevated levels of nitrates in village well water. For example, nitrate levels in the nearby well for Mountainair were .2 to .3; for Willard's well, .9 to 1.6, with some samples in Willard as high as 2.5. Normal levels are less than one milligram/liter.

The fact that the only source of nitrogen in the village is human waste makes the link between human waste and drinking water clear. And the fact that human waste can contain not only nitrogen but disease pathogens, residues of medications, and other chemicals lends further urgency to this problem .

In a situation in which acquiring more data could raise more questions and further delay needed action, it made sense to use data as significant indicators, but to rely most heavily on common sense: Given the physical conditions that had prevailed in the village for generations, how could contamination *not* be a problem, and one that would worsen?

The engineering firm, village officials, RCAC, the state facilitator, and EPA all agreed: contamination was likely—and likely to worsen. Wastewater within the village must be better managed.

But did residents agree? The answer to that question is examined further below.

Recommendations for defining the baseline

From our experience defining the baseline, some lessons and observations emerged.

Conducting the baseline survey

- *Conduct Part A of the survey as soon as you can.* The fact that the results of Part B largely confirmed what we learned from Part A suggests that if you cannot initially afford to conduct Part B, you can still obtain valuable information from Part A while deferring Part B for the design phase of the engineer's work.
- *Avoid any perception of conflict of interest* by having the survey managed by a third party, not the engineering firm, which might be seen as benefiting from a recommendation for a construction project.
- *Use the survey as a valuable outreach and education tool* that can help build understanding of the project's goals.
- *Ensure homeowners' cooperation* by explaining clearly to them why the survey is needed.
- *Recruit residents to conduct Part A* of the survey through personal interviews with homeowners. Train interviewers so they understand the significance of the information they are gathering and can answer questions about the form.
- *Keep it simple.* Terms used on the survey form and by interviewers must be clearly explained, to avoid jargon that residents may misunderstand.
- *Consider language barriers and literacy levels.* In a bilingual community, someone who speaks the second language should go door to door to help gather information. If residents are to complete survey forms themselves, reading levels must be considered in designing the form.
- *In rural areas, ask about wells*. Part A of the survey should include a question asking if wells are located on property, as they could serve as conduits for contaminants.
- *Be resourceful.* Residents' input at public meetings contributed to building baseline information. Information might also be obtained from local septic tank pumpers, installers, builders, plumbers, and hardware store staff.

Gathering other data

- *Identify data needed that are publicly available and gather them yourself*—for example, data on water quality—so you won't have to pay a contractor to do this for you. Sources are identified below.
- *Use geographic information systems* to gather and analyze data and visually display baseline conditions and what-if scenarios—and to present them to the public. They are a powerful visual communication tool.

Making decisions despite uncertainty

- *Don't rely on sampling data alone; rely on common sense*. Examine the physical setting and what is known about it and past history.

ACQUIRING AND MANAGING ENGINEERING SERVICES

Why the engineering firm is key

The engineering firm will be directly responsible for key functions in each major project phase, as described below. A detailed account of functions performed for Willard is presented in the appendix.

Planning phase

- assess baseline conditions to determine the nature and severity of the problem
- examine options for solving it
- assess any potential adverse socioeconomic and environmental impacts of the options and determine how to avoid or mitigate them
- estimate the cost of each option, including the total life-cycle cost
- prepare a comprehensive preliminary engineering report examining options and costs and recommend a solution
- revise the engineering report per public comments
- prepare an environmental information document to support the environmental assessment.

Design phase

- design the system selected
- prepare technical specifications the village can use to solicit bids for construction, help the village select a construction firm, and write the contract with the firm selected
- determine who owns vacant property needed for the recommended option and help acquire it

Construction phase

- monitor construction to ensure that systems installed comply with specifications. Because construction firms in New Mexico have not yet built systems that employ emerging onsite technologies, this oversight is particularly important.

Throughout the project, the firm will ensure compliance with federal and state laws and regulations and local ordinances; for example, the Antiquities Act and Endangered Species Act.

Given the crucial role played by the engineering firm and the cost of its services, in a very real sense, the engineer becomes a principal project partner. In a large city, the engineer would coordinate with a City Engineer in a public works department. In Willard, the engineer coordinates with the mayor and council and the state facilitator. And while the contract with the engineering firm defines its scope of work, the firm cannot simply be directed to proceed; its work must be integrated into the project. In Willard's case some requirements were modified as the project progressed.

Moreover, the engineer's role is more than narrowly technical: his expertise is a valuable resource that can help the public better understand the project's technical dimensions and thereby build support and confidence. The engineer should therefore attend public meetings at key points at which public involvement is required by regulation or is otherwise desirable.

How to select a firm

For the reasons cited above, selecting an engineering firm warrants considerable care. Because, at the outset of a project most communities cannot know the nature of the system they will need, they will want to select an engineering firm that possesses these qualities:

knowledge of a range of technical options, or the motivation to explore them

resourcefulness and creativity in formulating options

the communication skills to convey their knowledge in terms people in the community can understand

not only willingness but desire to listen to community concerns

Only after the community has thoroughly examined what it wants from an engineering firm should an RFP for engineering services be developed. The RFP should state clearly and completely what the community wants from the engineering firm, and ideally it will be developed by the individuals who will review proposals and recommend a firm.

> *Note:* The Professional Technical Advisory Board offers technical assistance to any party procuring engineering services, by helping them prepare an RFP. (See appendix.) So do some funding agencies.

We recommend that the engineering firm's fees be defined not as a percentage of construction fees but for specific services performed. This will remove any incentive for the engineer to design a needlessly costly system. Conversely, it is more equitable: some less costly projects can demand as much work from an engineer as more costly projects.

Willard's experience

For Willard, the state facilitator drafted an RFP that explicitly required evaluation of technical options for decentralized systems. The village council reviewed the RFP, approved it, and issued it.

A citizen's advisory committee was then formed to review proposals from engineering firms. An expert on public involvement helped the committee prepare for this task by reviewing exactly what the village wanted and formulating focused questions for bidders that would help match qualifications with specifications. Her book on this subject is cited in the appendix.

In the course of its deliberations, the advisory committee observed that it strongly preferred an engineer whose explanations they could understand, and it dismissed one candidate as "too technical"—a shrewd decision, given the importance of clear communication among all parties.

The committee presented a recommendation for a firm to the village council, which reviewed and approved it.

The state facilitator drafted a contract. The village council reviewed it, negotiated with the engineering firm to establish an acceptable cost, and approved the contract.

The engineering report

Equipped with the results of the survey and information from other sources, the engineer developed a preliminary engineering report that assessed and costed-out a set of technical options. The options considered ranged from conventional sewer collection and central treatment in lagoons to individual advanced onsite treatment systems.

Parameters against which each option was evaluated included

- likely public acceptance of the option
- how well each option would reduce nitrate levels in the effluent treated by each system
- construction costs
- operating and maintenance costs
- how much land would be required, where
- environmental impacts

We recommend that another parameter be considered, too: the extent to which operation and maintenance require the active involvement of homeowners.

While the engineer's work was sound, his preliminary report was not as clearly organized and written as it needed to be for lay people to understand it, and it was not easy to identify the preferred alternative or the rationale for it. Reviewers' comments addressed these problems, and the engineer revised the document accordingly. We believe the final product could have been clearer still.

Another tool: environmental assessments

While the purpose of a wastewater project is to protect the environment, such projects could produce potentially adverse impacts on the environment. For example, trenching could destroy cultural artifacts.

Projects that use federal funds are subject to NEPA regulations and must prepare formal environmental assessments. Projects that use state revolving fund loans must prepare environmental information documents, which also assess environmental impacts. But even for projects not subject to these formal requirements, we strongly recommend that communities

- require the engineering firm to assess potential environmental impacts and submit reports on their findings
- issue the draft reports for public comment
- review any comments and revise the report as appropriate

This will ensure that the public has been consulted and any significant potentially adverse effects have been identified and are adequately understood.

As engineers are fond of saying, *It is easier to erase a line on a drawing than move a pipe that has been installed in the ground.*

For Willard, the state facilitator prepared an environmental assessment. It examined effects on archeological, cultural, and historical resources; aesthetic values; air and water quality; threatened and endangered species; biological and botanical resources; and environmentally sensitive areas. The potential for generating odors was also examined, along with socioeconomic and environmental justice issues, overall and cumulative environmental impacts, and regulatory compliance.

The state concluded that any adverse impacts produced by the project could be reduced to acceptable levels, and it issued a formal Finding of No Significant Impact.

Recommendations for successful collaboration with the engineer

- *Take full advantage of technical assistance offered by funding agencies.* They can (1) help prepare the RFP and scoring sheet for evaluating proposals, (2) help residents prepare to interview firms that have submitted proposals, (3) help prepare the contract with the winning firm.

- *Encourage early and active involvement by residents.* They can serve on an advisory committee to (1) define what the community wants from an engineer, (2) help draft an RFP that reflects it, (3) review proposals, (4) ensure that the contract reflects what is wanted, (5) work with the engineer throughout the life of the project.

- *In the RFP and contract, stipulate the following:*

    Engineering fees will not be pegged to a percentage of construction costs. Rather, they will be fees for services provided.

    The engineering firm must examine a range of decentralized options. EPA's Web site, www.epa.gov/OWM/decent is a good place to start.

    Engineering documents must be clearly written and organized so that clients, who are lay people, can understand them.

    Each invoice submitted must clearly state what services were rendered in the billing period.

    The engineer must provide brief, frequent status reports to parties designated by the client. Where some officials and residents have Internet access, e-mail can greatly facilitate this, particularly because as the project progresses, the distribution list will grow.

    The engineer must prepare a report on any potential adverse environmental impacts so it can be offered for public comment.

    The engineer must share information with residents, by participating in public meetings and otherwise making information available informally—to a reasonable level of effort commensurate with engineering fees.

- *Encourage the engineer to dress appropriately for the community.* For example, rural communities may feel more comfortable with an engineer who is not wearing a business suit.

- *Encourage the engineer to function as a full project partner who is committed to the project's success,* so that he provides the full benefit of his experience and judgment.

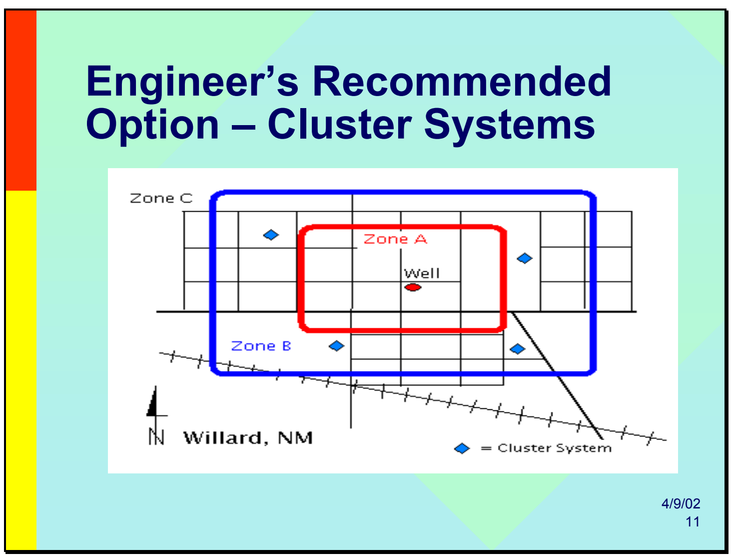
TECHNICAL OPTIONS AND WHAT WILLARD CHOSE

Weighing baseline conditions against the parameters cited above, and others, the engineer recommended a set of technical options that included basic, precast concrete septic tanks and leach fields.

But because a septic tank itself does not provide adequate treatment of wastewater, the engineer knew that placing septic tanks and leach fields close to the village well would not adequately protect groundwater. He therefore proposed to pipe wastewater from the homes closest to the well further away, to sand filters, as illustrated below. Essentially, the engineer coupled conventional septic tank technology with an advanced biodegradation technology.

And because the funding initially available could not cover the cost of developing a system for the entire village, the engineer proposed that work proceed in two phases, with the first phase addressing the most urgent potential public health problems.

After a public hearing to consider the option, the village council adopted the engineer's recommendation. (Please click on this image to focus it.)



- *Phase 1* will include the approximately 40 homes, with an estimated 104 residents, in the critical area within a roughly 885-foot radius of the village well, defined as Zone A.

  Pipes will be installed to carry wastewater from these home to five recirculating sand filters and then on to leach fields. Each filter, about 2500 square feet in area, will be excavated to a depth of about 4 feet and lined with a synthetic liner. Sand will be layered on top of rock; wastewater will be piped through distribution pipes onto the sand; water will percolate down through sand; bacteria will consume contaminants. The sand filters will promote biological treatment by affording bacteria a residence. Wastewater will be pumped from the filters to the leach field, from which it will re-enter the aquifer.

  Each filter will serve a cluster of about eight homes. The village will purchase five lots for the filters and adjacent leach fields.

Note: Homes beyond Zone A that now lack onsite systems will be included in Phase I, so that no cesspools will remain in Willard at the conclusion of this phase.

- *Phase 2* will include the remaining 60 homes in areas defined as Zones B and C. For each home in Zone B, individual septic systems using an advanced treatment system or additional cluster systems will be installed. For each home in Zone C, a septic tank will be repaired or installed and a leach field maintained next to it.

The option selected yields a set of significant advantages:

- Construction can be phased, easing funding constraints and thereby ensuring that the most pressing public health problems are addressed first—and soon.
- Tailoring the design to site-specific conditions protects the aquifer from homes closest to the village well.
- Tailoring the design to site-specific conditions minimizes construction costs: only installation and repair essential to bringing each piece of property into compliance will be performed.
- Employing five cluster systems reduces the costs of operations and maintenance.

PROJECT COSTS: ESTIMATES & ISSUES

How much will your project cost?

Understanding what your project will cost in the near-term and over the long-term is essential to determining what financing is needed, what funding options are appropriate, and how much local residents will have to pay for loan repayments and operating and maintenance costs. The engineering firm that develops your cost estimates should help you understand them thoroughly; the state Environment Department can also help.

Willard's costs cannot be taken as a predictor of costs other projects will incur. Project costs will vary from community to community to reflect the variability of site conditions and the severity of problems. They will also vary with local labor market conditions and the cost of materials.

Construction costs will be the lion's share. By their nature they are difficult to estimate: site conditions that could not have been anticipated are often encountered and "change orders" are commonplace. (A good engineering firm will allow for contingencies in developing its cost estimates.)

In preparing cost analyses, engineers traditionally use a 20-year accounting period. This does not mean the system will last for only 20 years; rather, it is a convention.

As a rule of thumb, the cost per household of a decentralized wastewater management system over 20 years may run from $10,000-$15,000.

For Willard, the 20-year life-cycle cost for Phase I and Phase II combined is estimated at $970,000; the estimated cost per household for Phase I is around $12,000; for Phase II, $9,000.

Because Willard's costs can offer a rough indication of scale and proportion, a detailed breakout is presented later in this chapter.

The potential deal-breaker: costs to residents

The issue with the greatest potential to derail the project is cost: what each homeowner will have to pay, probably in the form of a monthly fee, to cover the costs of operations, maintenance, and homeowner education and to repay the loan from the state.

In any community with a marginal economy and in which many residents have fixed incomes, this issue will inevitably loom large, and in Willard, it arose again and again. The extremely important—and sometimes subtle—public communication dimensions of this issue are discussed in the chapter on public involvement; on this page we address only its economics.

In Willard the monthly fee will pay for the following:

sand filters will be inspected
all service calls will be answered
septic tanks will be pumped approximately every 3 years
careful records will be kept of inspections, maintenance, and pumping
the state revolving fund loan will be repaid

Estimating operating and maintenance costs for a totally new system is not easy. And because by definition the Willard project is a demonstration project, the engineer could not look to a New Mexico precedent.

One factor works to Willard's advantage significantly. Repaying the state revolving fund loan over 20 years will cost each household $3/month. If the $417,000 hardship grant had to be repaid, too, the $3 would rise to $25/month. Because the grant does not have to be repaid, the cost to Willard of construction falls dramatically.

But in a sense, Willard, like all small communities, is burdened by a diseconomy of scale: the smaller the community, the larger the share-per-resident of loan repayments. This is because construction costs are not strictly scalable: some portion is independent of project size. This same is true of operating and maintenance costs.

Thus, the estimated maintenance costs for Phases I and II—$8/month and $15/month—are not easily reduced, and residents must simply decide for themselves how much preserving their drinking water is worth to them—in the near term and long term.

But residents do have some latitude in determining how to fund the monthly payment. Options include

- linking a monthly fee to water usage
- linking a monthly fee to the total cost divided by the total number of households
- increasing property taxes
- funding the cost through a gross receipts tax (but revenues in Willard are too marginal to make this an option

Technical assistance in determining monthly rates is available from RCAC, the New Mexico Rural Water Association, and the New Mexico Environmental Finance Center at the University of New Mexico, all listed in the appendix.

Estimates of Willard's costs

Construction costs and sources of funding

Phase I will cost about $480,000, principally for (1) design and construction management services provided by the engineering firm, (2) the cost to the village of purchasing the five pieces of property that the five sand filters and adjacent leach fields will be located on, (3) construction.

Funding for Phase I is available in the form (1) the one-time $417,000 EPA hardship grant, (2) the state revolving fund loan of $63,000 that is required as a match for the grant, (3) the $20,000 grant from the State Drinking Water Bureau.

Phase II will cost about $503,000, principally for (1) design and construction management services provided by the engineering firm, (2) construction.

Full funding has not yet been acquired.

Maintenance costs per household

Annual costs for operation and maintenance for Phase I are estimated at $10,020; for Phase II, including continuing Phase I costs, at $17,600.

For Phase I, the maintenance cost is estimated at $8 per month; $3 of this is to repay the $63,000 loan over 20 years; $5 is to cover the costs of operation and maintenance.

After Phase II is complete, the monthly maintenance cost could rise to $15 to cover the cost of maintaining the additional onsite systems for Zones B and C.

More-detailed cost estimates for Willard are presented below.

Willard Project Costs

Cost Component	Cost	Comments
Public involvement	~$250	Costs are incidental but essential: meeting rooms, refreshments, raffle prize, outreach materials.
Engineering firm: planning services Define baseline, identify options, develop cost estimates for options, formulate recommendation; coordinate with and provide information to village	$25,000	Fee tied not to percentage of construction costs but to specific services rendered.
House-to-house survey and field verification	$20,000	This figure is exceptionally high because we had no prior experience contracting for this kind of work and because severe scheduling problems escalated costs.
Engineering firm: design services	$37,000	Fee tied to specific services rendered.
Engineering firm: Phase I construction management services	$18,000	Estimated. Fee tied to specific services rendered.
Construction services: Phase I	$381,000	Estimated Includes cost of acquiring land for sand filters. As New Mexico contractors gain experience constructing systems that employ new technologies, this cost could fall.
Engineering firm: Phase II construction management services	To be determined	Not yet estimated.
Construction services: Phase II	$503,000	Estimated
Interest on state revolving fund loan: 1% of $63,000	$6823 over 20 years, or $341/year	Effective interest rate for combination grant/loan projects must be considered.
Operations & maintenance	Phase I: $8/month/ household	Estimated

Cost Component	Cost	Comments
	Phase II: $15/month/ household	Estimated
Incidental miscellaneous costs: permits, legal fees, recording fees	To be determined	Costs depend on specific circumstances, such as the number of easements and extent of legal review required.

Sources of Willard’s funding & support: Phase I

Source	Amount	Purpose	Comments
EPA	$79,000	Demonstration project to produce model ordinance and manual. Cover cost of experts and their travel, small portion of state personnel costs, equipment.	Not applicable to future projects.
NM Environment Department	In-kind services		State contributed $1,000 to obtain EPA $79,000 grant.
One-time EPA hardship grant State revolving fund loan	$417,000 grant $63,000 loan	Cost of constructing system.	15% of total must take the form of a loan. Award of the loan is contingent upon village’s adoption of fee schedule.
New Mexico Finance Authority	$90,000 grant	Construction grant to be used to start Phase II construction	
Rural Community Assistance Corporation (RCAC) bridge loan	[$56,000]	Short-term bridge loan to cover cost of engineering services to develop plan and environmental information document needed for village application for state revolving fund loan.	Loan repaid with the state revolving fund loan; did not add to total project cost.
RCAC	In-kind service	Help village apply for state loan and develop fee schedule for operations and maintenance.	
NM Drinking Water Bureau	$20,000	Contract with RCAC to cover cost of two-part survey: Part A, survey of homeowners; Part B, field verification of results of Part A.	Drinking Water Bureau provided funds to Construction Programs Bureau, which contracted with RCAC.
Homeowner fees	Estimated at $3/month with $417,000 hardship grant that does not have to be repaid; $25/month without.	Repay state revolving fund loan.	Homeowner fee matters most to residents because they pay for it directly.

Operations & maintenance costs estimated @$5 for Phase I ($12 total for Phase II)	Pay for monitoring, operation & maintenance, homeowner education.

RESOURCES YOU MAY BE ABLE TO TAP

Funding and technical assistance

The Willard project benefited from a one-time EPA hardship grant that cannot be replicated. But other sources of funding are available. Like Willard, you may need to tap more than one to assemble the funding you need.

The primary sources of funding for wastewater projects in New Mexico are the Rural Utility Service, the New Mexico Environment Department, the New Mexico Finance Authority, and Community Development Block Grants. Together they offer "one-stop shopping" sessions to help potential applicants learn about available funding, and they will be glad to help you explore funding options.

As a rule, agencies that offer funding can also offer some technical assistance.

As you review the table below, be mindful that interest rates may fluctuate.

> *Note*: Federal funds cannot be used to match federal funds. You will want to work with the funding agencies to determine how best to maximize funding.

Another source of funding is direct appropriations for specific projects from the state legislature. You will want to contact your state legislators to pursue this option.

Source and Contact Information	Type of Funding or Technical Assistance Federal funds?	Village, Town, City, County	Mutual Domestic Water Assn.	Coop
Apply to: Rural Utility Service, U.S. Department of Agriculture Contact: 505-761-4955 For rural areas and towns with 10,000 or fewer residents. Grants are for up to 75% of eligible costs in some cases.	Loan-grant combinations Straight loans Straight grants All are federal funds.	X	X	X
Clean Water State Revolving Fund Rural Infrastructure Program loans Apply to: NM Environment Department Construction Programs Bureau Contact: 505-827-2806	Loans Interest rates range from 0% to 3% Revolving funds are federal, from EPA, but may or not be construed as federal for matching purposes. Rural Infrastructure loans are state funds.	X	X	
Apply to: NM Finance Authority Contact: 505-984-1454	Loan and/or grant combinations Some are federal funds; some aren't.	X	X	X
Community Development Block Grants Apply to: NM Dept. of Finance, Local Government Division Contact: 505-827-4950	Grants up to $400,000 Match required; can be in-kind services These are federal funds.	X		
Apply to: EPA, Region VI Contact: 214-665-7168	Grants that require a match in funding These are federal funds.	X		
Apply to: Border Water Works Contact: 505-988-4270	Small loans Promotes self-help projects for water and wastewater; provides technical assistance, including limited engineering		X	X

Source and Contact Information	Type of Funding or Technical Assistance Federal funds?	Village, Town, City, County	Mutual Domestic Water Assn.	Coop
Apply to: U.S. Army Corps of Engineers Contact: 505-342-3278	Technical assistance for engineering studies and design of wastewater systems	X		
Apply to: Economic Development Administration, U.S. Dept. of Commerce Contact: 512-381-8160	Grants These are federal funds.	X		
Apply to: Rural Community Assistance Corporation (RCAC) Contact: 505-983-5074	Loans @ 5.5 to 6.5% interest	X	X	X
Apply to: Rural Water Association Contact: 505-884-1031	This national organization is active in NM and provides in-kind services that can be used to match some other funds.	X	X	X

INFORMING AND INVOLVING RESIDENTS

Commitment and constraints

From the outset of the project, it was understood by all parties that for the project to succeed public acceptance would have to be won. This was partly because residents—none of them affluent—would have to pay a monthly fee to cover the costs of operation, maintenance, and homeowner education.

But beyond acceptance, as stressed above, actively involving residents in the project pays enormous dividends:

- Their knowledge of the community can be invaluable.
- Their involvement can help them better understand the project's merits and make its goals their own, which further contributes to long-term success.

It was because of the crucial importance of public acceptance and involvement that the state facilitator enlisted an expert on public involvement. However, while she was willing to spend more time in Willard, our limited budget could not support this. And a more severe constraint was lack of a local champion who was present in Willard on a continuing basis to share information and to informally elicit concerns, identify misconceptions, and address them.

The state facilitator, who had a full-time job in Santa Fe, tried to address matters on this important front as best he could in the course of his visits to Willard, but those visits could not be frequent.

Limited village staff and lack of Internet access was a further constraint on communication.

The fact that the position of village clerk was part-time for the first year-and-a-half of the project hampered communication, too.

Inevitably, as communication suffered, so did continuity and follow-up.

The following pages describe the efforts we did make. But we believe that, even within severe constraints, we could have managed communication, meetings, and public involvement more effectively. Recommendations that may benefit other projects are offered at the end of this chapter.

Promoting public involvement

Advance notice of meetings

Because the project's use of federal funds triggered NEPA regulations, the village had to hold a formal public hearing on the draft environmental assessment. But the village went far beyond this requirement to share information and involve the public.

Project issues were discussed at nearly every council meeting during the year 2000. Public meetings were held on February 27, June 14, July 6, August 28, and December 11, 2000. The state facilitator prepared and reproduced flyers to announce each meeting in advance and sent or delivered them to the village clerk, who then distributed them to every household.

Formal public hearings were held September 28, 2000, and January 8, 2001. They were advertised at least 30 days in advance by posting a notice in the Village Hall and Post Office and distributing flyers, supplied by the state facilitator, to each household.

In some instances, more than one flyer was sent announcing a meeting or hearing.

Several bulletins reporting on project progress were also distributed to each household. (Examples of flyers and bulletins are included in the appendix)

Attention to setting and meeting dynamics

We took care to plan in advance the optimum way to present information in the form of exhibits and posters and to configure the meeting room.

We also worked to promote a good dynamic among speakers and listeners that would encourage discussion.

Chronic low attendance

Despite vigorous efforts to promote and induce participation—including provision of food, pot luck suppers, and a raffle—for most of the first 2 years of the project, attendance at public meetings averaged only around a dozen people.

We speculate that several factors converged to keep participation low: residents were busy with their own personal matters; the village has many priorities that compete for attention; if people don't perceive a crisis, they are unlikely to enlist in a crusade.

Other forms of public involvement

Public meetings are the most visible and continuing form of public involvement. Less visible but more active forms are valuable, too. We made deliberate efforts to encourage and facilitate them, and Willard residents stepped forward to play several roles:

serving on the citizens' advisory committee to select an engineering firm

helping with Part A of the house-to-house survey

contributing information to Part A of the survey contributing information to Part B of the survey

reviewing the engineer’s preliminary report and raising questions and comments

making their private wells available for sampling

As the project proceeds, they may also

form an advisory committee to help the village council develop the fee schedule for maintenance and operation

help the village identify owners of property needed for easements

make their private wells available for monitoring

Protest!

A citizens' petition

Throughout 2 years one issue simmered and arose from time to time in various guises. Twenty-one months into the project—after the council had voted to proceed with the engineer's recommendation, and on the eve of its decision to execute the binding grant and loan agreements necessary to proceed with the project—the issue erupted.

The issue was cost—and in particular, what each homeowner would have to pay each month to repay the state loan and for operations and maintenance. A petition signed by twenty-five residents protesting the cost of the project and disputing the need for it was presented at a council meeting. At the meeting, which was heavily attended, several hours were devoted to heated discussion of various topics, some of which had been previously discussed and were assumed to be closed.

One project advocate challenged the crowd by asking where they had been for the last year when meetings were held and issues discussed. The mayor observed that the project had been well-publicized, and that in a vote taken at the last meeting residents agreed the project should proceed. He outlined options and costs and observed that people now seemed primarily concerned with the size of monthly fees. He suggested they attend the next meeting, when the new ordinance and fee schedule would be discussed. He later affirmed to the state facilitator the council's decision to proceed with the project.

However, as of this writing, the Council has voted only to impose the $3/month fee required to repay the state loan; the monthly fee required to pay for operations and maintenance has yet to be approved.

Some of the questions raised at the meeting, along with other questions that arose in the course of the project, are presented below.

Possible reasons for resistance

While the estimated cost per Willard household had been announced earlier in a flier and discussed in public meetings, it had evidently registered only gradually. Should this figure have been announced much earlier—and more loudly—to give residents more time to understand it, debate it, and perhaps come to accept it?

Because the Willard project was a demonstration, we had no precedent for estimating cost data, and we had to wait for the engineer to complete a preliminary report to obtain cost data. Thus, we could not have provided such data at the start of the project with any degree of precision. But if a "worst case" figure had been announced, to get the dialogue going, and then replaced with better estimates when they became available, what would have been the result?

Another factor hurt the project: recent increases in charges for water and solid-waste management made residents less receptive to yet another expense.

And a subtle factor may have been at work. As in many communities, some Willard residents align along factions rooted in long-standing family animosities. Some residents may have opposed the project because it was supported by a faction unfriendly to them; they may have reached for the cost issue as the most powerful one they could invoke for opposition. That is, cost may have been a proxy for personal differences.

Whatever its source, resistance to cost reflected a deeper problem: residents' lack of understanding of how their wastewater could contaminate their drinking water, and the potential gravity of that problem.

That in turn reflects the need for not only public information but basic public education. Recommendations for addressing this need and issues related to public involvement are presented at the end of this chapter.

Questions from residents that demand clear answers

The questions below arose in the course of the Willard project and are likely to arise in other projects. We urge the closest attention to them, early on.

Questions raised directly by residents

- *What will this cost me? We've never paid for this before; why should we pay now?*

  As noted above, this was the bottom-line question, and many other questions were essential variants on it or attempts to invalidate the project so that the cost issue would go away.

  For all projects, the issue of cost to homeowners must be weighed against the costs of not solving the problem. For a village, this could be erosion of property values and cessation of village life.

- *Why should people who have already invested in their own septic tanks pay for someone else's? Why should people who live on the outskirts of the problem have to pay for the solution?*

  The wastewater-management system is integral to the drinking-water system that the community already pays for. And because the project will benefit the community's environment, all residents will benefit from the project and should share in its cost.

- *If we can't pay the monthly fee, will our water be turned off?*

  Yes. Community water and wastewater service providers have the authority to terminate service if fees are not paid.

- *Will my property taxes rise if a new septic tank is installed on my property?*

  The village council, in consultation with the community, will decide how to pay for the cost of the system. Raising property taxes is one way; others are user fees similar to utility bills and gross receipts tax.

- *Is village water really threatened? Sampling results vary. And if the water table is dropping, contaminants won't reach it. What will happen if we do nothing?*

  Once a pathway between human waste and drinking water is established, many forms of contamination are possible. Therefore, given the uncertainties inherent in sampling, residents will do best to use data as indicators and rely on common sense: *How could drinking water not be contaminated?*

- *Why can't we just dig a new well in another location?*

  The state must protect all groundwater from contamination, not just the water you happen to be drinking. It is against the law for you to continue to pollute groundwater.

- *Why can't we just treat the water?*

Preventing contamination is cheaper than treating contamination.

- *How long will the proposed system last, anyway? How much maintenance will it require? Will we be replacing it all over again in 20 years?*

  Every system, including sewer systems, requires maintenance and, eventually, repair and even replacement of some components. Proper maintenance prolongs every system's lifetime. In preparing cost analyses, engineers traditionally use a 20-year accounting period, but this does not mean that the system will only last for 20 years. Onsite systems are expected to last as long as conventional sewer systems.

- *Why is the state forcing this project on us?*

  The state facilitator repeatedly stated in public meetings and in meetings with village officials that (1) the project would only be pursued if the village chose to pursue it, (2) the state was making funding available for studies that would provide information the village could use to make its own decisions. In fact, Willard has made its own decisions.

  Because the project lacked local champions who could be continuously visible, some residents perceived the project as a state not a local project.

- *Who will help the village with the paperwork for this project?*

  The state routinely helps communities with paperwork, by providing electronic forms and templates that can be adapted. Other funding agencies can help, as can RCAC staff.

Other questions that required answers

- *What's the big project-management picture? What will happen, when? What is the process/what are the steps?*

  At the outset of the project and throughout, it would be helpful to present a milestone chart depicting key project steps, to help residents more readily grasp the "big picture" and appreciate the very real progress they were making.

- *How can residents participate? How can residents help?*

  From the very outset of the project it would be useful to sketch the many ways residents can participate. This would both encourage involvement and underscore that the project belongs to them.

Recommendations for informing and involving the public

Keep the Big Picture front and center

- *Present the project's Big Picture* early and often, and in the form of a graphic, so everyone shares a common understanding of key milestones and the sequence of necessary steps, and can see progress achieved and an end point.

- *Encourage public involvement early on, continually, and in many forms.* Help residents understand the range of roles they can play.

- *Remember the "50-30-20 rule."* It is a commonplace that 50 percent of the public is unlikely to care about any given initiative; 30 percent may support it, but silently; 20 percent may be vocal in expressing their views. It is therefore important to remember that views that are vocalized may not be representative.

- *Take context into account.* What other public issues are competing for attention? for residents' dollars? Consider how this affects timing and the way you frame your case.

Exercise communication savvy

- *Take facilitation and mediation skills as seriously as technical, financial, and legal resources***.**

- *Remember that you are literally going into people's back yards.* Unlike a campaign to build support for adopting, for example, a bond issue, building support for wastewater management involves physically investigating homeowners' private property. Homeowners must be approached with sensitivity and respect.

- *Seek local champions.* They can work toward project goals, recruit other residents to participate, and help earn acceptance. Record the names of every individual who expresses interest and how to contact them and let them know how they can contact you. Keep champions informed so they in turn can share the latest information. Meet personally with as many people as possible—and listen to their questions and concerns. Asking them how their neighbors view the project can not only provide valuable information about those neighbors' concerns but may indirectly elicit the speakers' concerns.

- *Be mindful of factions within a community*—for example, family antipathies that go back several generations. You can't solve these problems, but you can factor them into your planning for public involvement. And you can be mindful of the possibility that opposition that manifests itself as concern about, for example, cost may mask other issues.

- *Talk with residents one-on-one.* Talk with people in senior citizen centers and other social settings.

- *Listen strategically and respond.* Throughout the project (1) anticipate questions likely to arise, (2) identify misconceptions, (3) be as attentive to what residents are *not* saying as to what they are saying, and try to elicit and respond to it. Our list of questions above is a useful reference here.

- *Don't mistake an orderly process for public acceptance.* Listen some more; listen more closely.

- *Don't assume that because you have distributed flyers and held a meeting that you have communicated effectively*. Listen some more; listen more closely. Again, ask people how their neighbors view the project.

- *Stage an outreach event;* for example, show a video on wastewater management and follow it with informal commentary by several experts and a question & answer session.

- *Remember that audience composition changes through time.* Because different people may attend different meetings, it is necessary to repeat core messages again and again.

- *Consider expediting the public involvement process by sending controversial messages.* If potential funding will only be available for a limited time or if contamination may be severe enough to demand immediate action, you may not have the luxury of slowly and steadily building public understanding, involvement and acceptance.

  Instead, you may want to announce a plan of action and loudly state an estimated cost per household to galvanize—and focus—public debate. Over time, debate about costs may prove constructive and help accustom residents to the prospect of monthly fees.

  You may also want to communicate a tougher message at the outset: residents without adequate septic tank systems are violating the law; this project can help them achieve compliance.

Explain the basics clearly and communicate effectively

- *Help residents understand pragmatically* (1) the basic nature of the physical problem, (2) practical options for physical solutions, (3) practical options for funding. One-on-one communication is always best.

- *Avoid a hard-sell.* However convinced the project's sponsors are that the project is essential, the final decision must rest with local residents. They must come to the decision in their own time, and in their own way.

- *Create public information materials of professional caliber.* Use flyers written in a clear, human voice; keep them brief and to the point.

  Use good design and color as a draw. If you can afford the services of a graphic artist, use one.

  Create an identity for the project by (1) using a consistent visual signature, (2) using a consistent and positive tag line. (Ours is *Keeping Willard's Water Clean.*)

- *Publicize meetings heavily and offer inducements.* If possible, over a period of several weeks, distribute several notices for a single meeting. Enlist the community's clerk in publicizing the meeting. Offer refreshments, a raffle.

- *Plan and conduct meetings strategically*, paying close attention to how the size of the meeting room, its layout and the meeting agenda can affect meeting dynamics. During meetings, encourage people to talk, particularly women, who may be largely silent. To present technical information, rather than lecturing to a group, use table-top displays that offer opportunities for one-on-one exchanges.

> *We must protect our water for our grandchildren.*
>
> The one woman who spoke at a public meeting

- *Clarify and simplify vocabulary*. In written communication and in meetings, use clear terms and use them consistently. For example, EPA rules require a "facility plan." But a decentralized system does not require building a facility, and there is no need to confuse residents by introducing this term, which has the further disadvantage of suggesting large capital construction costs.

- *Be mindful of literacy levels and bilingual needs.*

Use new communication technologies, if possible

- *Use the Internet* as an outreach tool and a project management tool. The small rural communities that most need this kind of project are least likely to include many households with Internet access. But e-mail and a Web site can be powerful tools over the entire lifetime of the project. Gaining Internet access warrants an investment up front, if only in the form of one modem and an Internet Service Provider account for the community's computer.

- *Use a digital camera* to document project development. This tool may be worth an investment, too. To promote feelings of ownership, post photos on the project Web site and in the Village Hall, and incorporate them into fliers and bulletins.

- *Use geographic information system tools to graphically display baseline conditions and* what-if *scenarios*

Be prepared to quit; be quick to celebrate

- *Be prepared to "pull the plug."* If after reasonable effort, residents seem unlikely to make the project their own, abandon the project and direct your efforts elsewhere, where they are likelier of success.

- *Celebrate progress.* As soon as a key milestone is met, report the news widely. At key points, issue news releases. When the waste-water management system begins operating, hold a ceremony attended by local, county, and state officials and environmental health organizations. This will help reinforce residents' sense of accomplishment.

- *Remember long-term goals.* The project can succeed over the long-term only if residents understand its fundamental importance and are committed to supporting operations and maintenance. As new generations and new residents come along, public education must continue.

SUMMARY OF PROBLEMS ENCOUNTERED

Many problems summarized below have been discussed above. We have consolidated them here for ready reference and as a prelude to the recommendations that conclude this guide.

Sticker shock

Residents who have not been paying for wastewater management may resist a new payment—particularly in a community that is not affluent. In Willard, recent increases in charges for water and solid-waste management aggravated this problem.

Perceived cost inequities

Why should I pay for my neighbor's septic tank? was a question posed by residents who had spent money to install or upgrade their own septic tanks.

The fact that the technical solution defined and ranked physical zones added a twist: people on the perimeter wondered why they should pay at all.

Lack of a crisis and of compelling data

Because residents were not ill, and because data on nitrate contamination were limited and somewhat ambiguous, it was necessary to rely on a common-sense argument that contamination was inevitable and that the problem is easier to deal with sooner rather than later.

Because the village had competing priorities, those not perceived as urgent were at a disadvantage.

Lack of understanding of the potential gravity of wastewater issues

The issue of cost reflected this problem, with the result that some residents perceived the project not as a welcome solution but as a problem itself.

Had more residents understood the grave nature of the problem, more of them might have become local champions.

Distance and limited funding for the state demonstration project

The state facilitator works in the state capital, Santa Fe, 84 miles and about 1 hour and 45 minutes driving time from Willard. This distance was a barrier to maintaining a presence in Willard and ensuring continuity and follow-through.

The project budget could cover only a few trips to Willard for experts on public involvement and creation of wastewater management districts.

Lack of a local champion

It was extremely difficult to compensate for the lack of someone local who could gather and share information, build support, and signal the local character of the project.

Community factions

It was necessary to function as a sociologist to identify informal patterns of authority and competing factions within the village.

Animosities complicated the process of building consensus around project goals.

Part-time government

Village officials are unpaid and part-time; they are busy with other tasks, have limited time to devote to new projects.

The village clerk was part-time for the first year-and-a-half.

Some meetings scheduled were not held; phone calls were not always answered; messages left were not always promptly responded to.

Limited village communication infrastructure.

The village clerk has a fax but lacks Internet access; the part-time clerk had few computer skills; computer and printer capability were limited.

Delays and discontinuities

Delays and resultant discontinuities dissipated the core team's focus from time to time, and lack of steady, visible progress threatened to dissipate fragile community support.

Acquiring easements or purchasing needed land can be time-consuming. It may be difficult to determine a fair market value in the absence of recent sales; to determine who owns property; to contact the owner.

Inadequate data

The village lacked an accurate detailed map.

The County Tax Assessor's data on property boundaries and ownership are not up-to-date.

Data on the location and condition of septic systems were not complete.

Data from water samples can pose ambiguities.

A less-than-clear key engineering document

While the engineer's work was technically sound, his preliminary report was not easy for lay people to understand.

Funding limitations, uncertainties, and delays

To qualify for the hardship grant for construction, the village needed to provide matching funds. The match would take the form of a loan from the state revolving fund. To obtain the loan, the village had to submit a preliminary engineering report. But without the grant or the loan, it could not afford to pay the engineer to prepare the report.

To cover the cost, RCAC agreed to extend a bridge loan. But RCAC had never made a bridge loan to cover a state revolving fund loan. It soon realized that if, after receiving the engineering report, the village decided not to proceed with the project, the village might not apply for the loan that would enable it to repay RCAC. This uncertainty delayed the engineer's work.

Needlessly burdensome funding applications

The federal and state funding processes imposed two requirements that Willard could not meet. Both seemed pointless.

> The state requires that to obtain a loan, a village submit an attorney's statement documenting that the village is a village. But most villages do not have attorneys, and the state created the village in the first place and so should know it exists.
>
> EPA requires applicants for hardship loans to submit data on unemployment rates and median income. Those data did not exist at the village level.

And for a small village, the application process and paperwork are intimidating and burdensome.

Different sets of incentives

Ideally, long lead-time would allow for a slow and thorough process of public education and involvement. When public support fully materialized, the village council could move forward.

But federal and state funds do not remain available indefinitely; they must be obligated. And project costs may rise with time if, for example, the price of oil spikes.

This created schedule pressures.

When to "pull the plug"

With the clock ticking on funding, lack of adequate local support could be fatal. And over the project hung the question, *If Willard doesn't move more quickly, shouldn't we make the funding available to another community?* At every step it was necessary to assess community support and project viability.

But despite all these problems, some serious, the project is in fact proceeding. Other communities can take heart: success appears possible, and the outcome is worth it.

Moreover, one of our biggest problems was lack of a New Mexico precedent. We hope the Willard project has solved that problem for you.

RECOMMENDATIONS FOR FEDERAL AND STATE GOVERNMENT

Our experience in Willard introduced us to some problems we had not anticipated and helped us better grasp some we had. What we've learned points toward steps that state and federal agencies can take to minimize or solve these problems.

One early success

In fact, one problem has already been solved: the "catch-22 problem that required up-front funding. The state revolving fund loan required that applicants submit a preliminary engineering report and an environmental information document to apply for a loan. But such plans must be prepared by engineering firms, at considerable expense, and many communities can't afford this expense. Like Willard they need a bridge loan to cover it. Nor can the community be confident that having submitted the requisite report it will receive the loan.

At our urging, legislation has been enacted to extend Rural Infrastructure Program funds, previously available only for water projects, to wastewater projects for use as bridge loans. Those loans offer low interest rates that reflect market conditions.

Recommendations for further improvements

We offer the following recommendations for consideration by state and federal officials, and we encourage people working on their own community wastewater projects to lend their support to this agenda, as well.

- *Encourage a Big Picture/systems approach to thinking about New Mexico's wastewater problems.*

  Characteristically, wastewater issues are addressed on a piecemeal basis, as they present themselves in the form of requests for funding and compliance problems—not in terms of allocating limited resources to projects ranked according to the urgency of present and potential public health problems.

  Data that could support such decisionmaking are fragmented among several agencies.

  To better understand the problems communities face, the state can consolidate existing data, analyze needs across the state, and allocate resources accordingly.

- *Create a universally accessible, shared database, in a geographic information system.*

  Portraying data in a geographic information system linked to the New Mexico Environment Department's Web site will (1) give all interested parties access to a common data base, (2) will contribute to better-informed decisionmaking, (3) will present the effects of decisionmaking for public examination.

  Data can portray (1) what is known about the location and severity of wastewater problems in New Mexico; (2) the current fiscal year allocation of federal and state funding for infrastructure to manage wastewater, the technical option selected, and the per capita cost for households benefited; (3) it can portray the backlog of funding requests.

- *Broaden the scope of state and federal funding agenices' decisionmaking.*
  Not all agencies that fund wastewater-management projects formally require consideration of decentralized systems, and too often such consideration is perfunctory and the option is not fully explored. And funding agencies are focused on narrow fiscal questions, principally whether a loan applicant can repay the loan, not whether the loan money will be spent cost-effectively.

  State and federal agencies can require that *to proceed with a costly centralized sewer system, the applicant justify it against a decentralized system.* For federal agencies, guidance directives for EPA Regions, USDA's Rural Utility Service, and HUD's Community Development Block Grants are appropriate mechanisms for this purpose.

  They can also encourage communities to consider a wide array of options for decentralized systems.

- *Consolidate state responsibility for funding wastewater management projects.*

  Currently, the New Mexico Department of Finance, the New Mexico Finance Authority, and the New Mexico Environment Department all fund such projects.

  Short of organizational consolidation of this function, coordination would be desirable.

- *Simplify and streamline the loan application process and forms.*

  Make them less intimidating and less burdensome. Eliminate requirements for information that cannot be supplied or that the state can obtain from another source.

- *Educate the engineering community*.

  Because the potential market for construction of decentralized wastewater systems in New Mexico could be on the order of hundreds of millions of dollars, the engineering community should be motivated to pursue it.

  Engineers must take continuing education courses to retain their licenses. More courses on alternative onsite technologies can be made available and engineers can be encouraged to prepare themselves for what is an emerging market. EPA can promote and make such training available through its Small Flows Clearinghouse. Taking advantage of curricula offered at other schools, the University of New Mexico and New Mexico State University can offer courses.

- *Promote greater cross-disciplinary awareness.*

  The grave potential public health and environmental problems posed by lax wastewater management, the benefits of centralized management, the growing array of technical options for decentralized systems, and the advantages of such systems should be far more widely understood.

  This information should be aggressively shared with public policy analysts, public health professionals, environmental health specialists, teachers, planners, journalists, and the Extension Service. The federal and state annual Infrastructure Conference is one promising venue.

- *Expand help to communities in selecting and managing engineering firms.*

  The New Mexico Environment Department and RCAC provide technical assistance. Other agencies and organizations can, too.

- *Develop and distribute curricula for school children.*

  Particularly because water is such a precious resource in New Mexico and because all New Mexico citizens are responsible for protecting our water supply, basic sanitation practices that affect water quality should be taught in public schools.

  Drawing on extensive information resources from the federal government and non-profit organizations, the New Mexico Education Department can make an off-the-shelf curriculum available on line and can link it to geographic information system tools that will be exciting and fun for students to use.

- *Establish an on-line chat room for people working in New Mexico to adopt decentralized systems.*

  This will require administrative functions and some funding. A state agency or university or public interest group with foundation funding could assume this responsibility and link it with other efforts around the country.

- *Update this guide.*

  As more people gain experience adopting decentralized systems, this guide can be updated and refined to reflect what they learn.

  The fact that the guide is available on the Internet greatly facilitates revision.

  But this task, too, will require a commitment of resources. We hope a federal or state agency or university or public interest group will assume responsibility for it.